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POWER SUPPLIES UNLIMITED

NJE CORPORATION Kenilworth, New Jersey

INSTRUCTION MANUAL

REGULATED POWER SUPPLY
TRANSISTOR - DRIVEN FREQUENCY CHANGER
60 to 400 CPS

MODEL
TFC

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WARNING!!

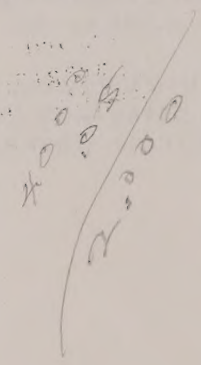
THIS EQUIPMENT EMPLOYS VOLTAGES WHICH ARE DANGEROUS AND CAN BE FATAL IF CONTACTED BY OPERATING PERSONNEL. EXTREME CAUTION SHOULD BE EXERCISED WHEN WORKING WITH THIS EQUIPMENT.

CORRESPONDENCE AND ORDERING SPARE PARTS

1. Each NJE Power Supply has an identification label located in the rear of the unit which bears the Model and Serial number of the particular unit.

2. When requesting Engineering data, reference should be made to the Model and Serial number.

3. When ordering spare parts, the information outlined in paragraph 2 should be given in addition to the NJE Part No. that appears on the parts list in Section VI.



Specification and Description

1. General Description-NJE Model E/TFC- is a low-cost half rack frequency changer, using completely solid state components, silicon power rectifiers, silicon zener diode reference and germanium control and power transistors. 90% of the wiring is accomplished with printed circuitry.

1-1 Electrical Specifications:

Input:

Model	Volts	Frequence	Line current	Power factor
E/TFC 115-100	105-125 207-253	50-65 cps	3.5 A	0.8
E/TFC 26-100	105-125 207-253	50-65 cps	3.5 A	0.8
E/TFC 115-200	105-125 207-253	50-65 cps	7 A	0.8
E/TFC 26-200	105-125 207-253	50-65 cps	7 A	0.8

The input is arranged for either 115 or 230 volt. The units are factory arranged for 115 volts. For 230 vac input see schematic.

Output: Continously adjustable by front panels potentiometer as indicated below.

Model	Volts	Volt Amperes	Frequency
E/TFC 115-100	105-130	0-100	380-420 cps
E/TFC 26-100	24-30	0-100	380-420 cps
E/TFC 115-200	105-130	0-200	380-420 cps
E/TFC 26-200	24-30	0-200	380-420 cps

Output Characteristics at 400 cps.

Power Factor .8 to unity. Other load power factors can be tolerated at reduced loads, contact factory for details.

Distortion 5%

Amplitude Modulation 3%

Static Frequency Regulation ± 1/2%

For greater accuracy on the 200 VA models, tuning fork options are available.

Static Load Regulation: ± 1% (± 4% for 26V units)

Static Line Regulation: ± 1/2%

Input Line Transient: For a line step of ± 10%, the output voltage excursion will not exceed 2%.

Recovery

30 milliseconds maximum for a load step change from no load to full load.

10 milliseconds maximum for a load step change from full load to no load.

Maximum overshoot 15V.

Polarity: The output can be floated up to 500 volts peak above or below ground. Either, line may be grounded to chassis.

Protection: The current is electronically limited during momentary overload or short circuit. If the overload persists the load is disconnected from the supply by a fuse. The power transistors are protected against over-temperature by an automatic resetting thermal switch.

Remote Programming Features:

Remote Frequency Programming terminals are available at the rear of the chassis.

Remote Voltage Programming terminals are available at the rear of the chassis.

External Synchronization: External synchronization terminals are available at the rear of the chassis.

Meters: Output voltmeter and ammeter accurate to 2% of full-scale rating are furnished installed on the front panel. Meters not suppled on ETFC models:

Duty: Rated for continous duty at ambient temperatures of from 0° C to 40° C with 60-cycle input. With 50 cycle input, the supply is rated for continuous duty at ambient temperatures of 0° C to 35° C. For operation outside of this temperature range, contact the factory.

1-2 Mechanical Specifications:

Mounting: Suitable for laboratory bench use, or by 19" rack mounting by means of rack adapter panels.

Model	H in	W in	Dim	Net W.	Shipping Weight
E/TFC 115-100	4 11/16	8 1/4	15 3/8	22 lbs.	30 lbs.
E/ TFC 26-100	4 11/16	8 1/4	15 3/8	22 lbs.	30 lbs.
E/TFC 115-200	5 1/4	19	16 5/8	41lbs.	60
E/TFC 26-200	5 1/4	19	16 5/8	41 lbs.	60

Finish: Exterior is smooth dark gray, panel has white trim. Interior metal work has appropiate paint plating or anodizing as required.

Termination: Input, output, and remote programming and synchronization terminals are available on barrier type terminal strip at rear of chassis. 400 cycle output is also available on the front panel.

SECTION II

INSTALLATION AND OPERATION

2-1 UNPACKING. The power supply is shipped in a cardboard carton which is floated on sufficient insulation in a heavy-duty shipping carton. Aside from normal precaution against damage to the unit in opening the cartons and removing the unit, no special procedures are required. The carton should be opened immediately upon receipt and the contents inspected for shipping damage. The Power Supply was checked electrically and mechanically before it left the factory, and is warranted to be in perfect operating condition. This guarantee does not cover possible damage incurred during shipment. Therefore, any evidence of mishandling, such as broken, deformed, or missing parts, should be brought to the attention of the transportation company and a claim should be entered. Remove top cover plate and inspect all components and wiring, both on the chassis and panel, as well as the mechanical condition of the housing. The literature packed with the supply should be removed and held for reference in operating the equipment.

2-2 INSTALLATION. The supply can be mounted in any convenient location for bench use, and requires no adjustment or modification for such application. If the unit is to be installed in a housing, it is recommended that the rack or cabinet used be equipped with angel brackets, shelves, or slides to receive the unit, rather than suspending the assembly by its front panel relay rack adapter. The unit is pre-drilled to receive the adapter.

CAUTION!!

In mounting this unit, consideration must be given providing adequate ventillating space for the forced-air cooling system of the frequency converter.

2. 2. 1 When the unit has been properly placed in position, or mounted in its rack and secured in place by the panel screws, refer to Figure 2-1 and make the following connections:

Item 1- Output Ground-The ground terminal (TB1-5 is used to extend a safety ground to the external load. It may also be used to ground one side of the balanced output thereby unbalancing the system to ground. Use a No. 16 A WG wire for this connection as required.

NOTE: The output ground connector can also be effected from the panel block binding posts.

Item 2- Output Connection-Connect the 400 cps load to the output terminals (TB1-4 and TB1-6) using No. 14 A WG wire. Wire size may vary depending on location of supply and load.

NOTE: The output load connection can also be effected from the front panel red binding posts.

Item 3- Remote Programming (voltage) Terminals (TB1-11 and TB1-12) are provided for the insertion in series of a remote control programming resistor. This circuit has a sensitivity of about 3.3 ohms per volt. When the panel voltage adjustment is set to minimum, the output voltage may be accurately controlled from minimum to maximum into voltage by varying the remote resistance.

Item 4- Remote Programming (frequency) Terminals (TB1-9 and TB1-10) are provided for the insertion in series of the other remote programming resistor. The circuit has a sensitivity of about 2.5 ohms per cycle. When the panel frequency adjustment is set to minimum, the output frequency may be accurately controlled from 380 to 420 cps by varying the remote resistance.

Item 5- External Synchronization-Terminals (TB1-7 and TB1-8) are provided for operating unit as a 2 or 3 phase unit in con junction with the adapter Model TPA 3-20 or TPA 3-30. The frequency changer can also be synchronized at this point by a precise laboratory generator. Consult factory for details.

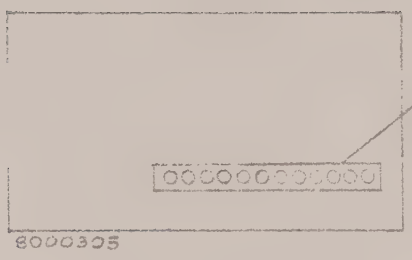
Item 6- Input Connection-Connect a deactivated input line (normal 115/230 volts, 60 cycles, single phase) to the AC input terminals. Connect " hot " lead of system to (TB1-1) neutral lead to (TB1-3) and the equiptment safety 230volt connection.

NOTE

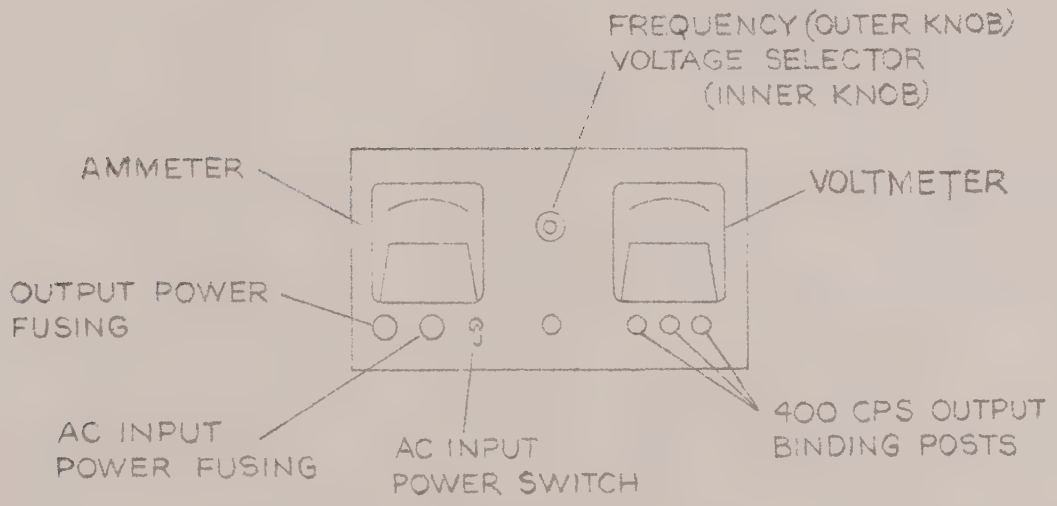
Unit is factory wired for 115 volt input Check schematic for other voltage.

2-3 OPERATION. Set the AC control switch in OFF (open) position Set the OUTPUT VOLTAGE control (inner knob) to full counter-clockwise position, and set the OUTPUT FREQUENCY control (outer knob) to center scale (400 cps). Energize the AC input line, then place the AC control switch in the ON position.

NOTE 1: The indicator on the front panel should light and a 400 cycle tone may be heard emanating from the frequency changer. Observing the panel voltmeter, adjust the load voltage to the desired value, by mæans of the OUTPUT ADJUST. Check the load current meter to avoid overload conditions.


TERMINAL BLOCK FOR CROSSCONNECTING INPUT AND OUTPUT POWER, REMOTE FREQUENCY AND VOLTAGE FEATURE AND EXTERNAL SYNCHRONIZATION.
8000305

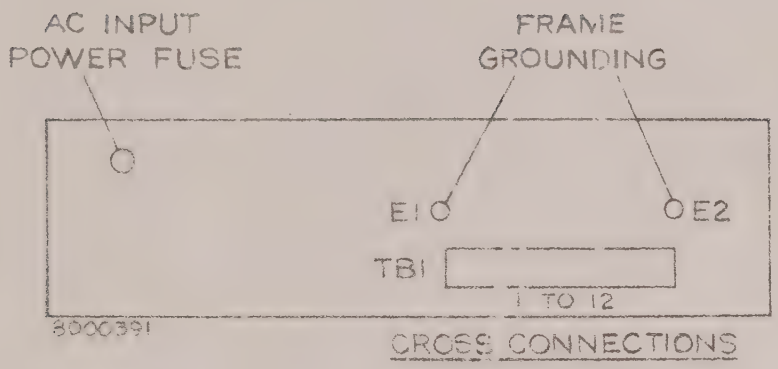
REAR VIEW



FRONT VIEW

(E) TFC-115-100
(E) TFC-20-100

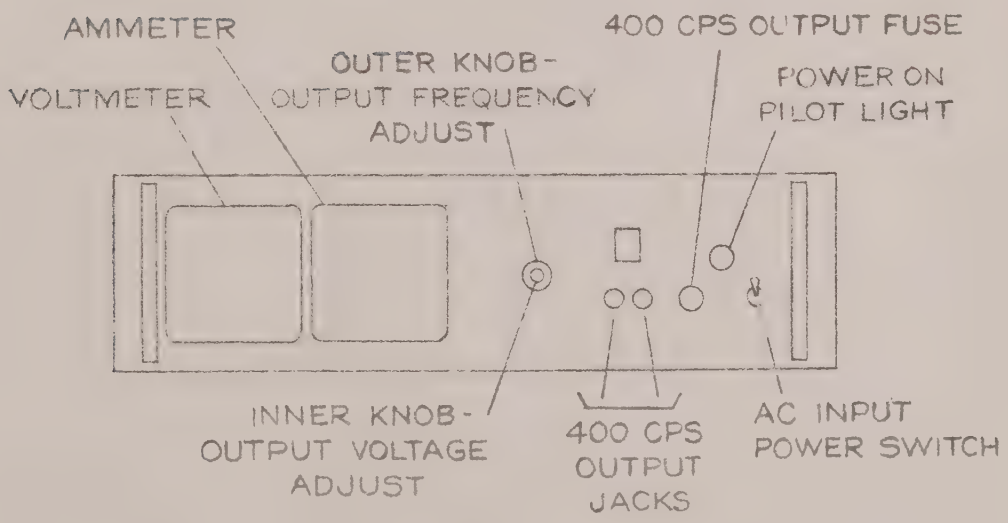
FIG. 2-1 LOCATION OF OPERATIONAL AND CROSSCONNECTING ELEMENTS OF FREQUENCY CHANGER



CROSS CONNECTIONS

AC INPUT
AC OUTPUT
EXT. SYNC.
REMOTE FREQUENCY PROGRAM
REMOTE VOLTAGE PROGRAM

REAR VIEW



FRONT VIEW

FIGURE 2-2

OPERATIONAL ELEMENTS AND CROSS CONNECTION
FOR 200VA UNITS

NOTE 2: If the pilot light on the front panel goes off and the 400 cps output voltage drops to zero, but the internal fan continues to run, (on 115V input units only; for 220V units fan will stop), the thermal over-temperature switch located inside the unit has opened up due to overload or too high an ambient temperature. After the thermal switch automatically resets and the output voltage again appears, check for the cause of the excessive temperature and/or 400 cps overload. If the required voltage value cannot be achieved, de-energize the input line and check connections on the rear terminal strip before referring to the troubleshooting section of this manual.

NOTE 3: It is normal for the cover of the unit to run hotter at no load than at full load. If the air flow is blocked, the unit will overheat and the internal thermal switch will trip.
Maximum ambient temperature is 35°C for 50 cps operation and 40° C for 60 cps operation.
The frequency will stabilize after a 15-minute warmup period. (the warmup drift will be a few cycles).

SECTION III

THEORY OF OPERATION

3-1 GENERAL: Refer to Figure 3-1 the Functional Block Diagram. The power is fed to the input of the transformer and step down rectifier. Part of this rectified DC is used to drive a master oscillator. The DC for the oscillator is further stabilized by a shunt regulator system which samples the output of the oscillator for the error difference.
The output of the master oscillator is transformer coupled to the emitter of the push-pull final amplifier, which is driven in accordance with oscillator pulse. The output of the final amplifier is sampled for amplitude changes which are monitored by second regulator system. The error difference is fed back to the final amplifier for effecting corrections as required.

3-2 INPUT CONTROL:- The power is applied to the frequency converter via the terminal board (TB-1) located in the rear of the unit. The unit is energized by the switch (S1) turn on and lamp (DS1) is lighted. The protective elements in part of the circuit consists of a fuse (F1) for overload conditions, a fan (B1) for cooling the unit and a thermal cutout switch (S2) for removing overtemperature conditions.

The transformer (T1) stepsdown the AC voltage to an appropriate level for application by the bridge rectifier (CR1 through CR4). The pulsating DC from the bridge is smoothed by the RC filter combination (R1 and C1). The DC power is divided between the 400 cps final amplifier and the 400 cps master oscillator. The largest portion of this power is used by the final amplifier which will be discussed later on.

3-3 400 CPS MASTER OSCILLATOR- The principle components of this oscillator circuit of transistor (A1Q1 and A1Q2), resistors (A1R1, A1R3, A1R4 and A1R11), capacitor (A1C7) and a special autotransformer (A1T1). The heart of the oscillator is this transformer (A1T1) which has a core material with an essentially rectangular B versus H (hysteresis) characteristic. Briefly described, the circuit is an overdriven push-pull amplifier with positive feedback derived from the output of an autotransformer.

For the following discussion, refer to Figure 3-2 and 3-3. The prefix designation (A1) has been conveniently omitted. When the 28 volt DC power is applied to the circuit, the two transistors (Q1 and Q2) will immediately start to conduct "slightly". The resistors (R1 and R3) arrange the circuit for a conductive condition and are commonly known as "starting resistors". However, due to some slight component difference, one transistor will immediately start to conduct " heavily ". This transistor will be arbitrarily designated (Q1). Almost simultaneously, the transformer action will develop two base voltages in feedback winding of the autotransformer (T1). One of the voltage is polarized in a manner that will turn transistor (Q2) " off " while the other voltage will be of the opposite polarity and will regeneratively turn transistor (Q1) "on" harder.

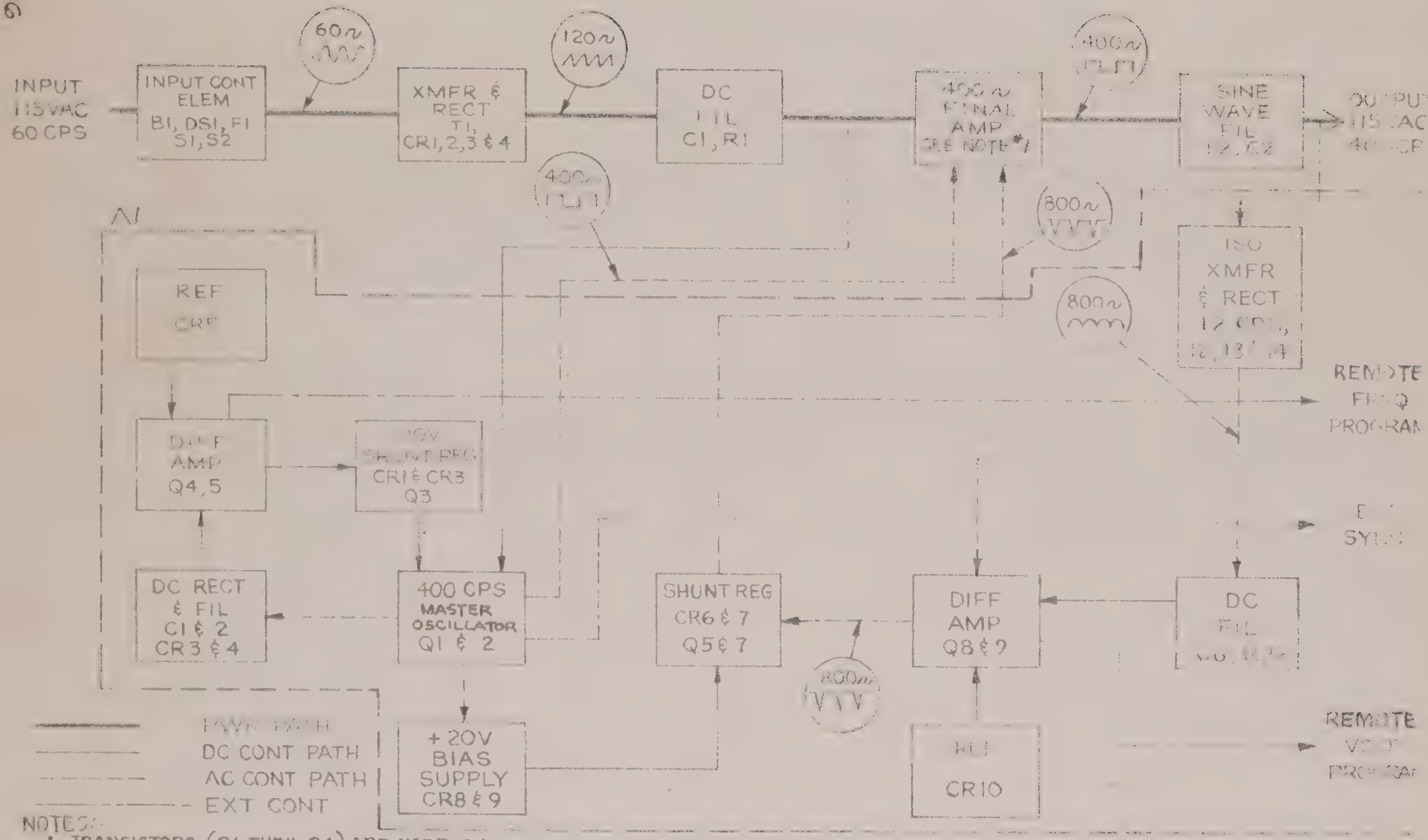
The transformer core saturates; the transformer action momentarily ceases and a quasi-equilibrium is briefly maintained. Then the status quo collapses, because the "on" transistor is saturated and the power demands of the transformer's exciting current at core saturation results in decline of power into the circuit momentarily.
Reversed transformer action sets in and the feedback voltages have reversed in polarity. Transistor (Q2) is now regeneratively turned "on" and transistor (Q1) is turned "off". This will continue until the core has saturated in opposite polarity region and the above cycle is repeated. The repetition period is determined, among other things, by the DC voltages used a portion omitted be made a function of voltage. The method used in NJE frequency changer model TFC is to provide a highly stabilized voltage system can be precisely controlled and the unit is programmable from a remote location by varying a resistor in series with the front panel control (R1A).
The AC output power of the master oscillator is essentially a square wave and is divided three ways. One path is the transformer coupled to the final amplifier and the other two paths are the-20 volt regulator and + 20 volt bias.

3-4-20 VOLT REGULATOR- For the following discussion refer to Figure 3-1.

Part of the AC output of the master oscillator is used to provide power for the differential amplifier circuitry. The AC power is rectified by diodes (CR2 and CR4) and the pulsating DC is smoothed by capacitor (A1C2). The differential amplifier, consisting of transistor (A1Q4 and A1Q5), has one arm stabilized by the reference diodes (A1CR5) and the other arm (A1Q5) is connected to the sensing divider (R1A, A1R9 and A1R10) for sampling the voltage variations. The shunt regulation (A1Q3) can be considered as a variable resistor under the control of the differential amplifier. The effective shunt resistance at any instant is determined by the error difference as determined by the base condition of the two transistors (A1Q4 and A1Q5). The regulated power is applied to the base of the transistor (A1Q1 and A1Q2) through the clamping diodes (A1CR1 and A1CR3).

3-5 FINAL AMPLIFIER -Transistors (Q1 through Q5 for 100 Va units and A2Q1, Q2, Q3 through A4, Q1, Q2, Q3 for 200 Va units) are arranged as a parrallel push-pull amplifier.

On the TFC-115-100 and TFC 26-100 Frequency Changer units the amplifier (Q1 through Q5) is switched "on" and "off" by the square wave pulse from the master oscillator. On the TFC-115-200 or the TFC 26-200. Frequency changes units the final amplifier unit (A2, Q1, Q2, Q3: A3, Q1, Q2: and A4, Q1, Q2, Q3, has an emitter follower amplifier (A3 Q3) driving the final amplifier. This emitter follower is driven by the square wave pulse from the master oscillator.



NOTES:
1. TRANSISTORS (Q1 THRU Q4) ARE USED ON 100 VA UNITS AND TRANSISTORS (AQ1, AQ2, AQ3 THRU A4Q1, Q2, Q3) ARE USED ON 200 VA UNITS.

FIG. 3-1

FREQUENCY CONVERTER
FUNCTIONAL BLOCK DIAGRAM

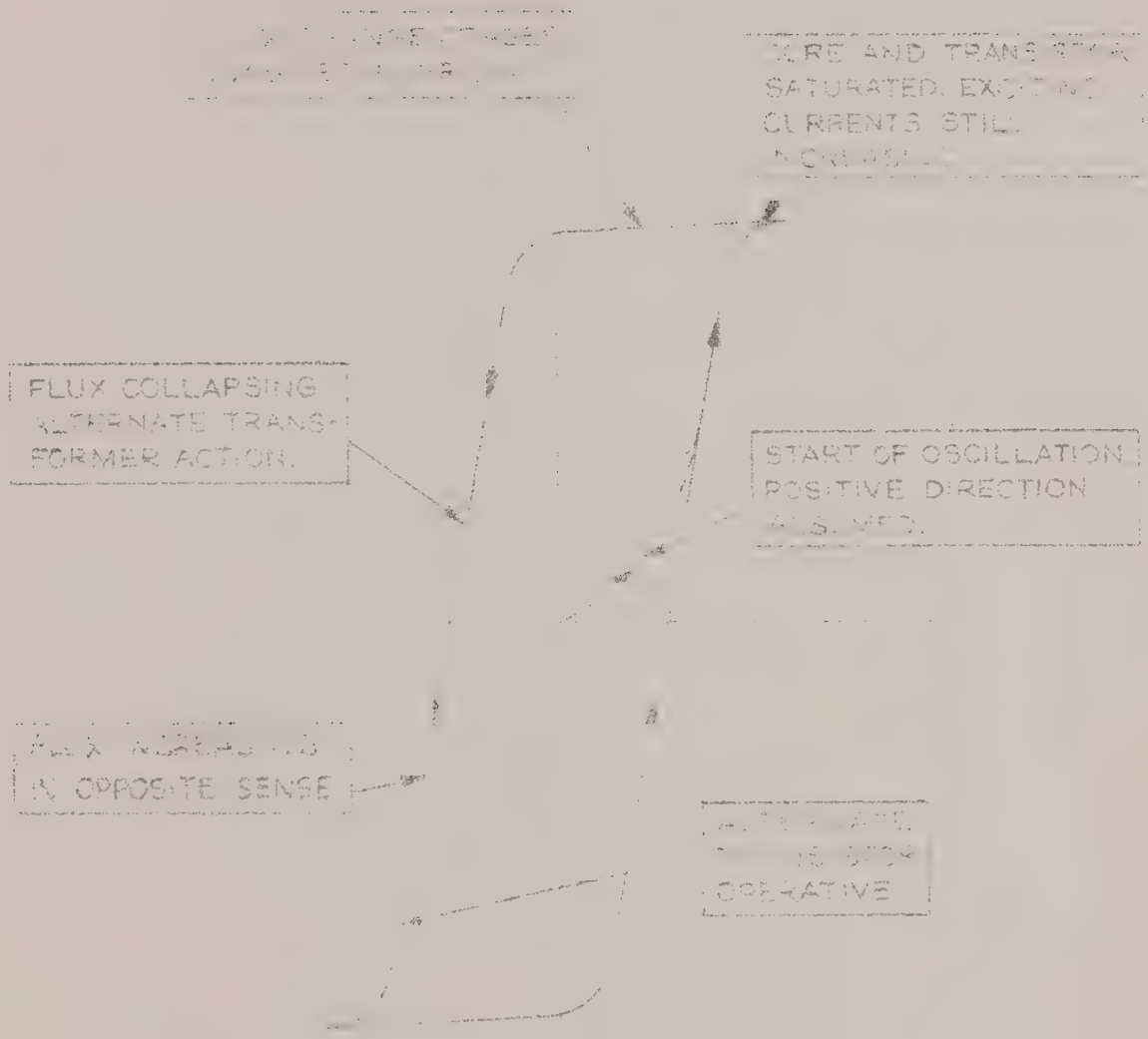


FIG 5-2

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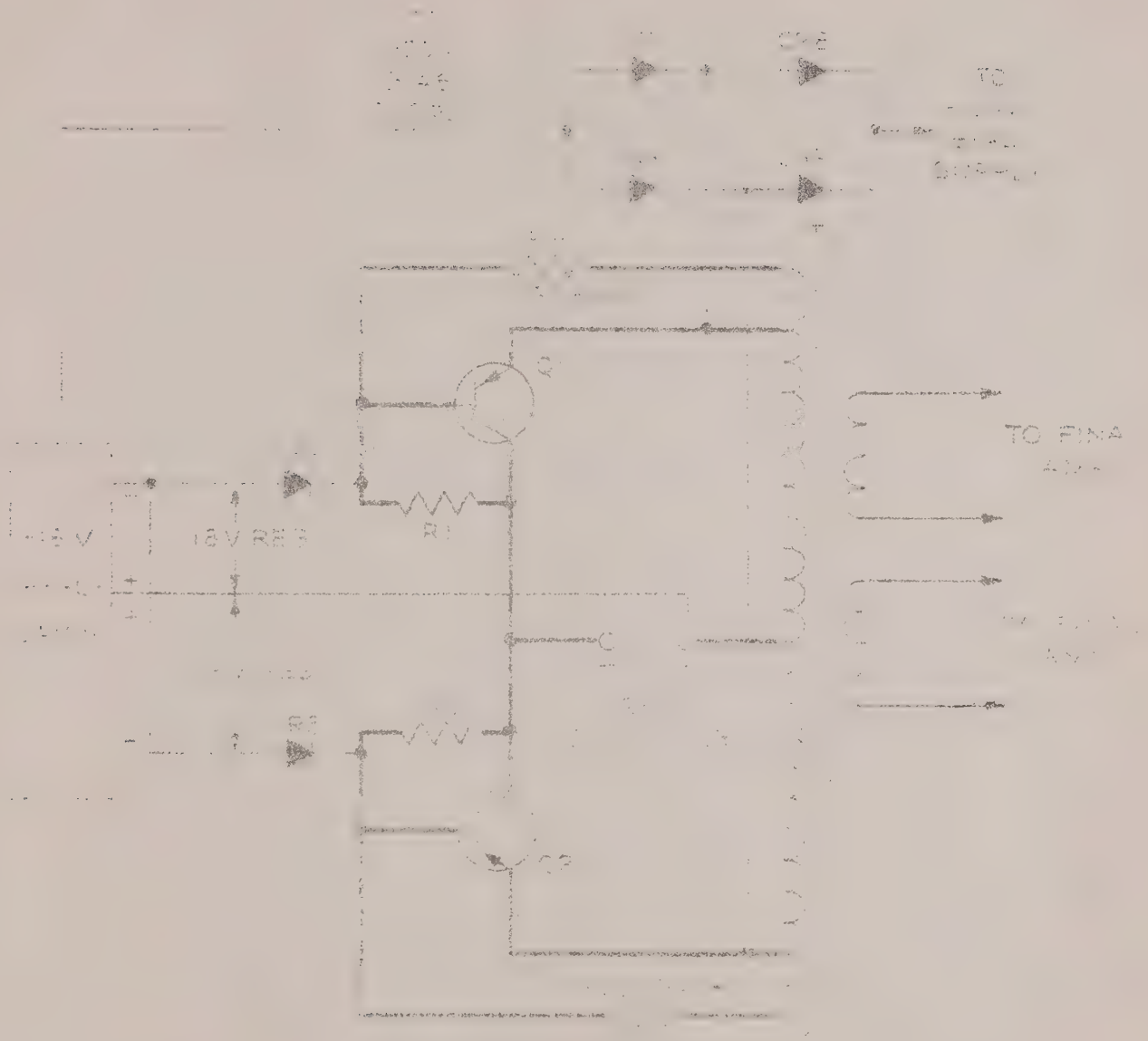

TO FINA
R1

This AC power is transformer (T2) coupled to the sine wave filter which consists of the secondary of transformer (T2) and capacitor (C2). This LC combination filter passes the principle 400 cycle component which is appled to the output terminals. At this point, a small portion of the output is continually sampled for voltage variations.

3-6 SECOND REGULATOR - The sampled voltage from the output is applied to transformer (A1T2) and rectified by diodes (A1CR11) through (A1CR14). A portion of the pulsating DC is smoothed by the RC filter (R22 and C6) and applied to the reference diode (A1CR10) and load resistor (A1R2). The other portion of the pulsating DC is applied to the base of transistor (A1Q8).

The differential amplifier combination of transistor (A1Q5 and A1Q9) has the sample voltage on the base of (A1Q9) and the pulsating DC on the other as mentioned above.

3-7 TUNNING FORK- On the TFC-115-200 and the TFC 26-200 units a tuning fork options is available for a higher degree of frequency stability. The output of the tuning fork drives a two stage emitter follower which synchronizes the master oscillater. The free running frequency of the master oscillator must be 10 cps below the tuning fork frequency for proper synchronization. It will take about 15 seconds after "turn on" for the tuning fork to come up to the required frequency (some frequency jitter can be expected during warmup.

SECTION IV

MAINTENANCE

4-1 GENERAL: This supply is designed for stable operation over long periods of time. However, if trouble develops, standard test equipment normally found in the Electronic Laboratory would be required. If the customer decides to do complete servicing of his premise, one or more of the fodlowing pieces of test instruments are required.

Instrument	Range	Remarks
Oscilloscope	General Purpose	General Troubleshooting
Frequency Counter		Precise Frequency Check
Multimeter (ohmmeter)		General Troubleshooting
AC Voltmeter (Precision)	0-150V	Precise regulation check
Variable Autotransformer	0-140 V AC 7 AMPS	General Troubleshooting
Dummy Load	() Range depends on supply rating)	

WARNING!!

THE POWER SUPPLY SHALL BE DE-ENERGIZED WHENEVER ANY COMPONENTS ARE REPLACED.

4-2 PREVENTATIVE MAINTENANCE- The principle item that will require attention is the cooling arrangement. The power supply generally requires some amount of convection air currents for cooling purposes. If the air currents are dust laden, a problem will arise that can lead to premature component deterioration.

This condition reduces the cooling efficiency of the supply. We therefore recommend a periodic cleaning if dusty climate prevails.

CAUTION!!

VACUUM CLEANER MAY LOOSEN THE SMALL PLUG IN TRANSISTORS.

4-3 TROUBLESHOOTING- A chart has been provided for ease of identifying source of trouble. Use this chart in the following manner:

First- Locate symptom in left hand column.

Second- Read across for numbers indicating order of probable causes shown on top.

4-4. ALIGNMENT AND ADJUSTMENT

4.4.1 Frequency Calibration or Adjustment- The unit normally does not require adjustment for frequency. If certain components are replaced, a re-alignment for frequency is mandatory.

NOTE: If a frequency "trimming" is required only, Step #1 may be omitted as required.

Components associated with frequency calibration

A1CR5- Breakdown Diode (reference)
R1A- Output Frequency Adjust- Var. Res.
A1R9- Output Frequency Trim- Var. Res.
A1R10- Output Frequency Range- Var. Res.
A1R12- Frequency Regulator- Var. Res.
A1T1- Oscillator Transformer

Steps (Frequency Calibration)

1. Set OUTPUT FREQUENCY TRIM AND OUTPUT FREQUENCY RANGE variable resistors (A1R9) and (A1R10) to the middle of their range and set FREQUENCY REGULATOR variable resistor (A1R12) fully clockwise. Remove fuse (A1F1) from holder.

   NOTE: All items of this step located on 83 PC-1, printed circuit board.

2. Set OUTPUT FREQUENCY ADJUST variable resistor (R1A), located on front panel, to the 400 cps marking.

3. Connect a frequency counter across the cathodes of diodes (A1CR2 and A1CR4) located on printed circuit board.

4. Energize the TFC frequency converter unit.

5. Readjust OUTPUT FREQUENCY TRIM variable resistor (A1R9) for 400 cps as indicated on frequency counter.

   NOTE: Clockwise direction decreases frequency.

6. Rotate OUTPUT FREQUENCY ADJUST variable resistor (R1A) fully clockwise and then completely counter-clockwise.

   NOTE: The two settings represent the lower and upper limits of the frequency range of the unit and should be 380 to 420 cps. If this range requirement is not met, then readjustments of step 7 are required.

7. Readjust OUTPUT FREQUENCY RANGE variable resistor (A1R10) for proper range.

   NOTE 1: The counter clockwise direction decreases the range.

   NOTE 2: Variable resistive controls (A1R9) and (A1R10) have some interaction. Back and forward adjustments will be required until the specified voltage range and 400 cps calibration requirements are met. Replace fuse (A1F1).

8. Arrange output of unit for making a full load to no load change. Monitor output with frequency counter during load change.

   NOTE: If change in frequency is more than 1 cps, readjust FREQUENCY REGULATOR variable resistor (A1R12) as required.

9. Repeat above steps 3 through 7.

10. Place cover on the unit and allow 15 minutes of stabilization. Give the unit a final frequency check at output terminals (J1 and J2) and trim variable resistor (A1R9) as required.

4.4.2 VOLTAGE CALIBRATION- The unit normally does not require adjustments for voltage. If certain components are replaced, a realignment for voltage is mandatory.

COMPONENTS ASSOCIATED WITH VOLTAGE CALIBRATION

A1CR10- Breakdown Diode (reference)
A1R16- Output Voltage Trim- Var. Res.
A1R17- Frequency Resistor
R1B- Output Voltage Adjust Var. Res.
A1T2- Isolation Transformer

Steps (Voltage Cal.)

1. Set OUTPUT VOLTAGE ADJUST variable resistor (R1B), located on front panel, fully counter clockwise.
2. Energize TFC Frequency converter unit.
3. Connect precise 150VAC voltmeter across the output (J1 and J2) terminals.
4. Readjust OUTPUT VOLTAGE TRIM variable resistor (A1R16) until output voltage reads 105V .

   NOTE: The clockwise direction decreases the output voltage.

5. Check upper range of OUTPUT VOLTAGE ADJUST variable resistor (R1B).

CAUTION!!

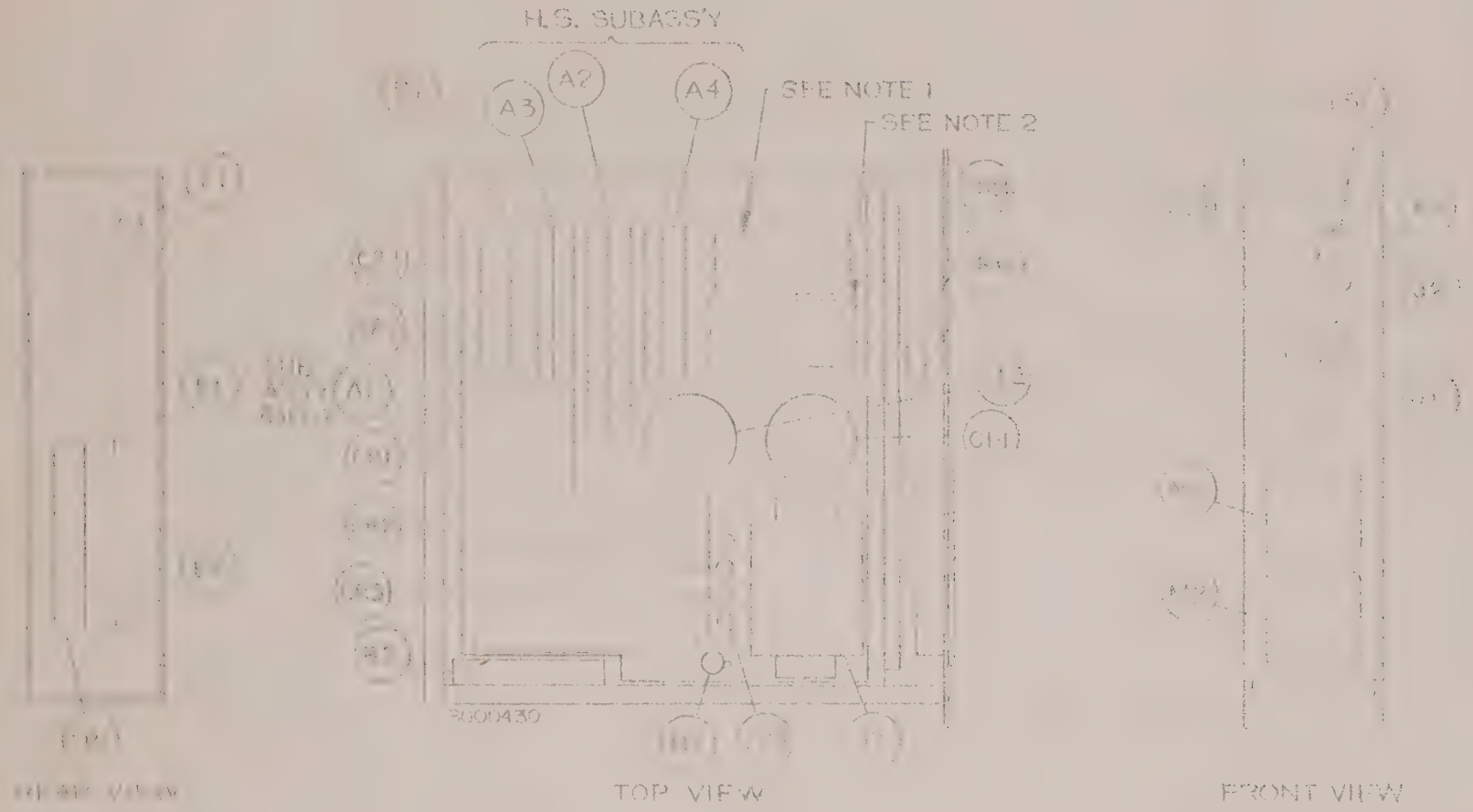
If the output voltage reaches 150V, (250V on E/TFC-26 model turn off unit immediately. Troubleshooting is indicated.

4.4.3 TUNNING FORK ADJUSTMENT (TFC-115-200 and TFC-26-200 only).

1. Remove plug-in tunning fork (Z1) from its socket.

2. Set frequency trim (A1R9) or front panel frequency control (R1B) to about 10 cps below the tunning fork frequency.

3. Replace tunning fork subassembly (Z1) in its socket and turn unit on. During warmup the frequency of the unit will be at about 385 cps and in about 15 second synchronize at 400 cps (providing 400 cps fork is used.) Some frequency jitter can be expected during the 15 second period.



NOTES:

1. THIS AREA RESERVED FOR TRANSFORMER (T2) [illegible] ON SOME UNITS.
2. THIS AREA RESERVED FOR TUNING FORK SUB-ASS'Y (A5) WHICH IS USED ON SOME UNITS WHEN HIGH DEGREE OF FREQUENCY STABILITY IS REQ'D.

FIGURE 4-1

PARTS PLACEMENT FOR MAJOR COMPONENTS

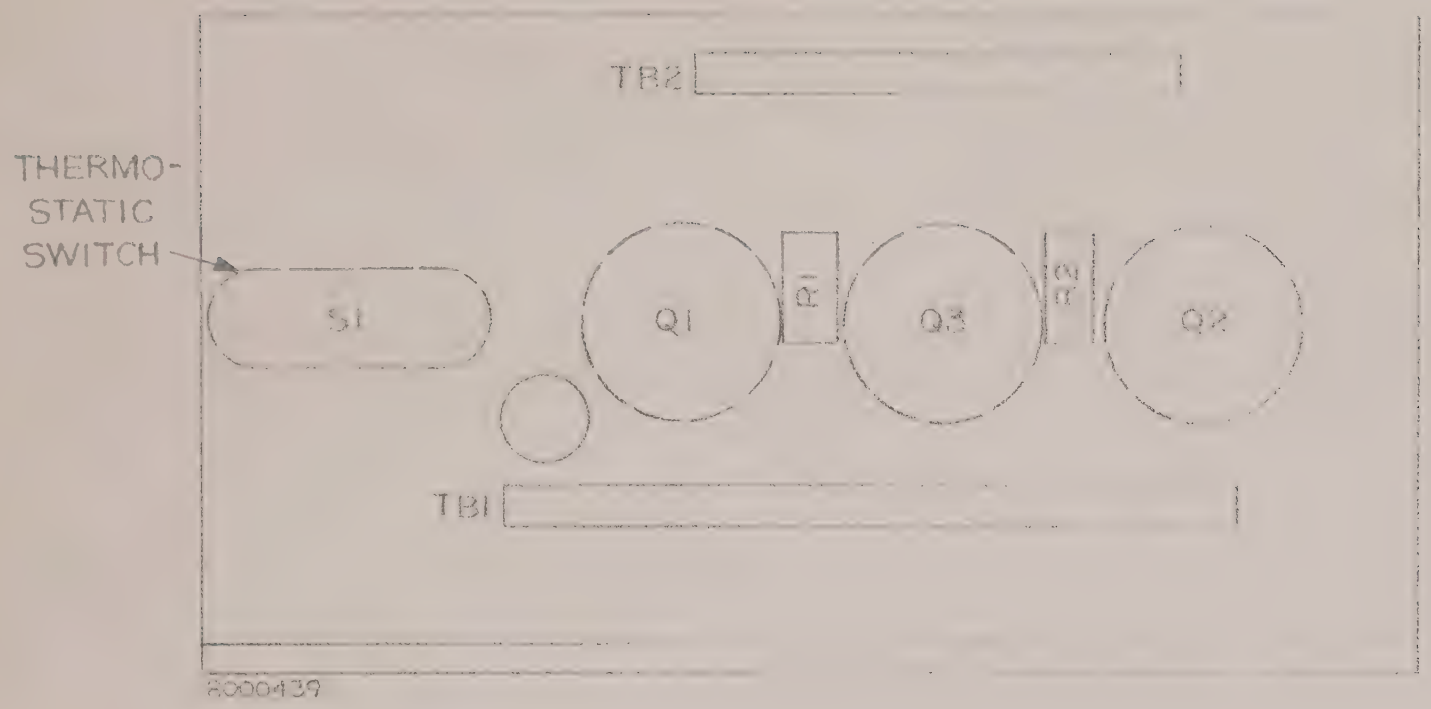


FIGURE 4-2B

PARTS PLACEMENT FOR SUBASSEMBLY
(A2),

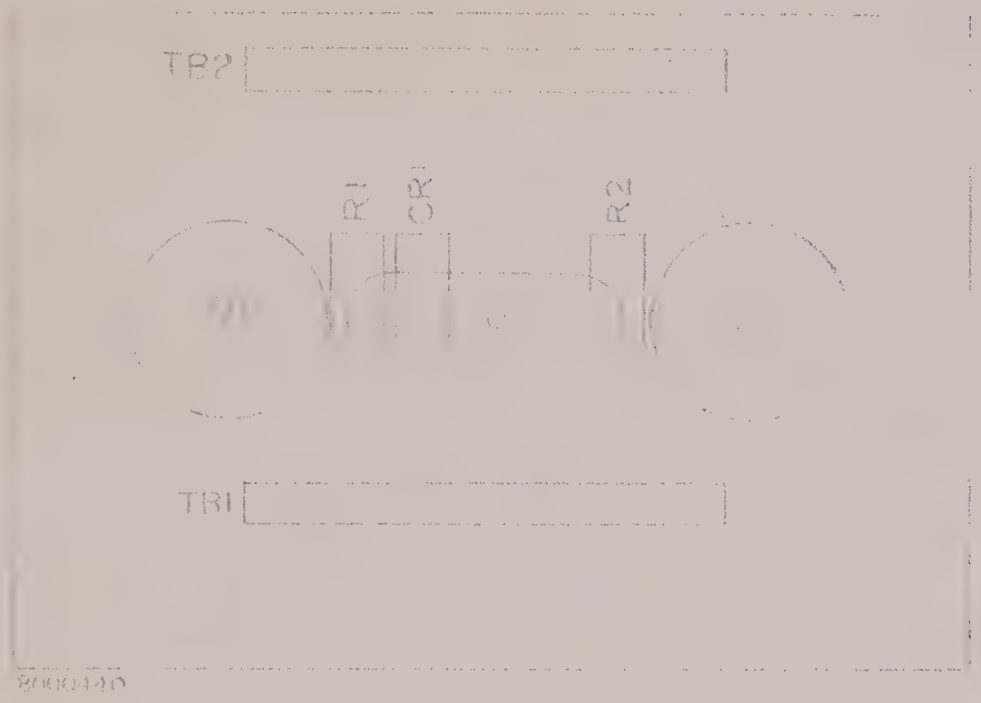
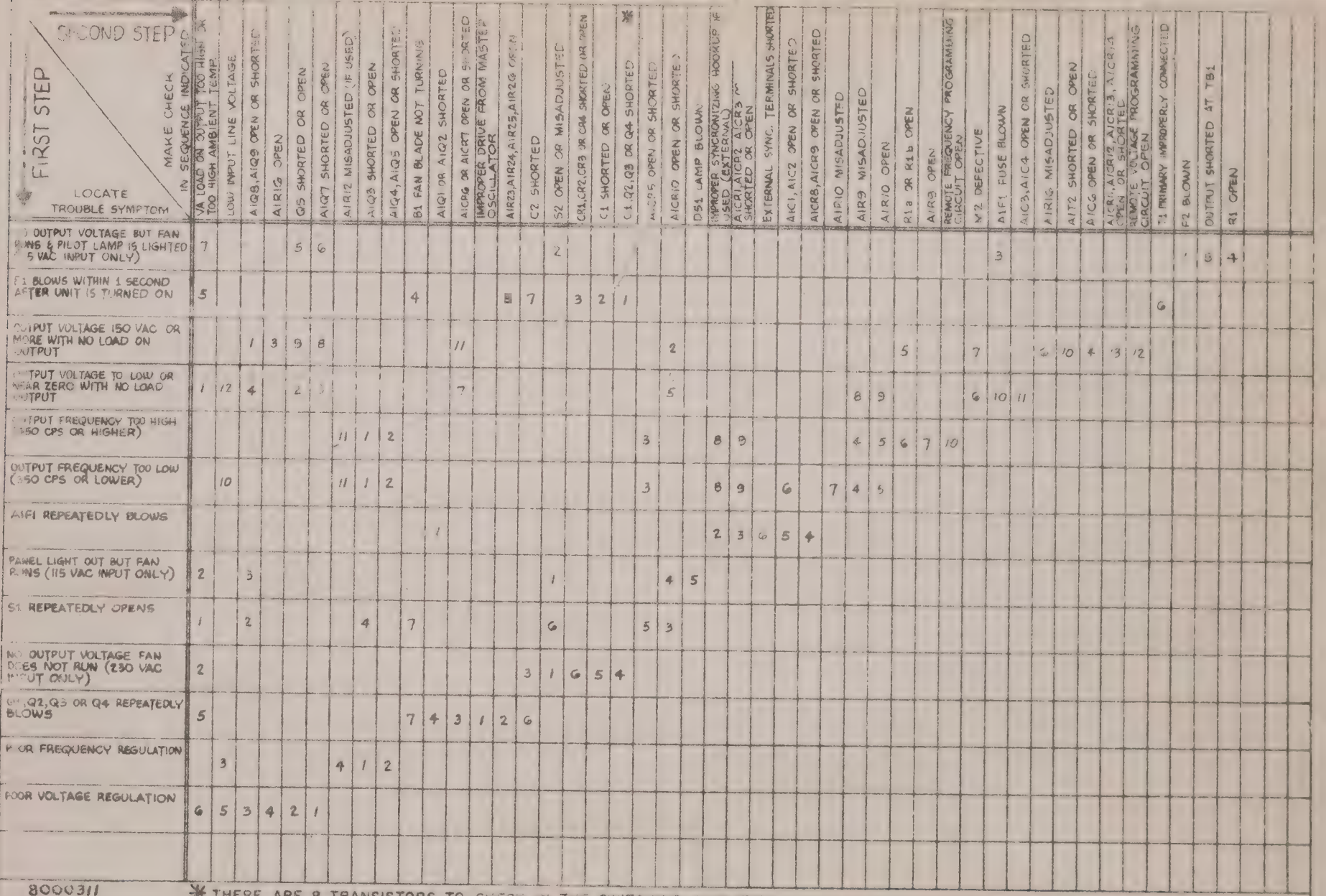


FIGURE 4-2

PARTS PLACEMENT FOR SUBASSEMBLY
(A2 & A4)

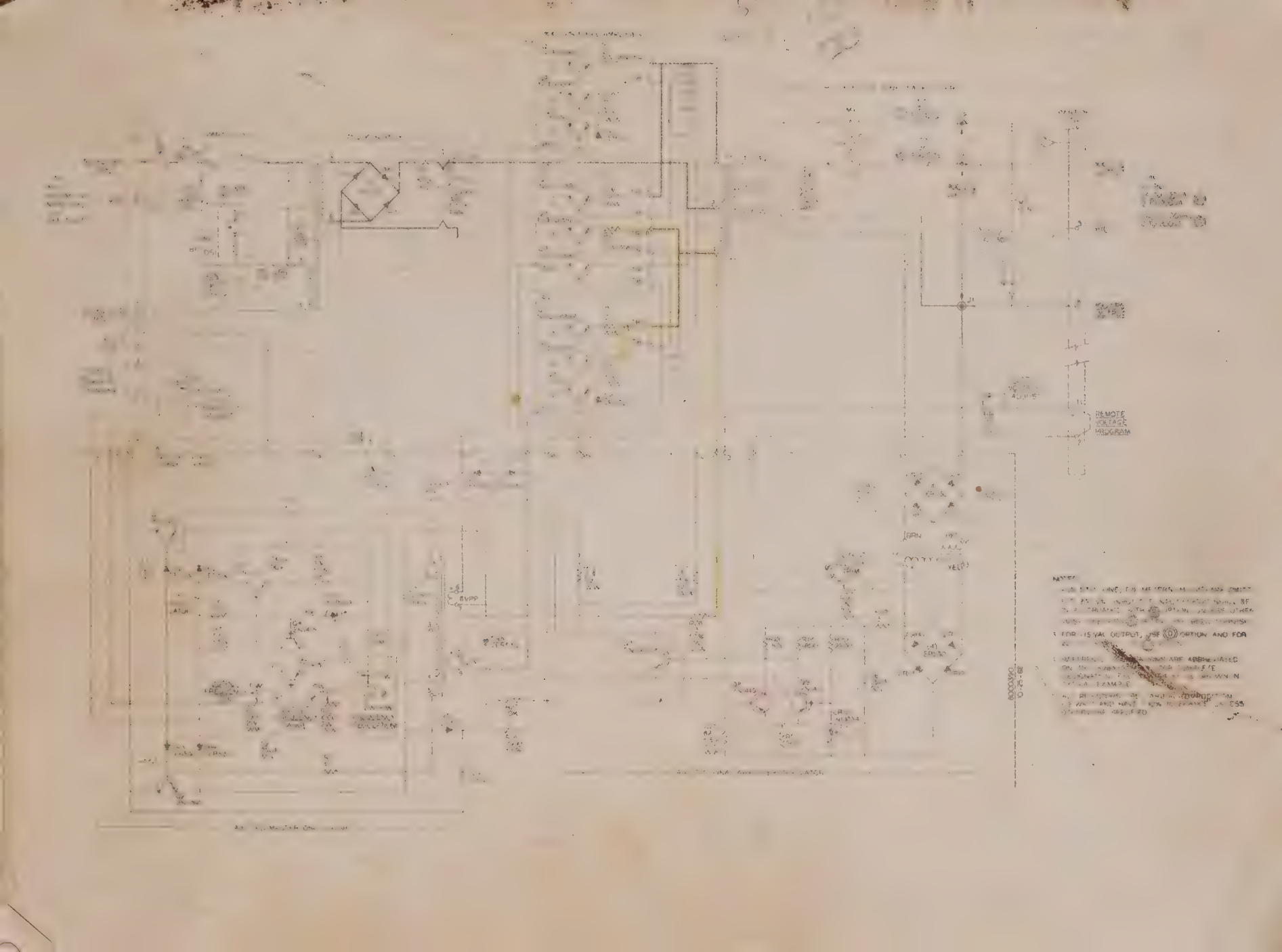

SECOND STEP
FIRST STEP
MAKE CHECK IN SEQUENCE INDICATED
LOCATE TROUBLE SYMPTOM
VA LOAD ON OUTPUT TOO HIGH OR TOO HIGH AMBIENT TEMP.
LOW INPUT LINE VOLTAGE
A1Q8, A1Q9 OPEN OR SHORTED
A1R16 OPEN
Q5 SHORTED OR OPEN
A1Q7 SHORTED OR OPEN
A1R12 MISADJUSTED (IF USED)
A1Q3 SHORTED OR OPEN
A1Q4, A1Q5 OPEN OR SHORTED
B1 FAN BLADE NOT TURNING
A1Q1 OR A1Q2 SHORTED
A1CR6 OR A1CR7 OPEN OR SHORTED
IMPROPER DRIVE FROM MASTER OSCILLATOR
A1R23, A1R24, A1R25, A1R26 OPEN
C2 SHORTED
S2 OPEN OR MISADJUSTED
CR1, CR2, CR3 OR CR4 SHORTED OR OPEN
C1 SHORTED OR OPEN
C1, Q2, Q3 OR Q4 SHORTED *
A1CR5 OPEN OR SHORTED
A1CR10 OPEN OR SHORTED
D51 LAMP BLOWN
IMPROPER SYNCHRONIZING HOOKUP IF USED (EXTERNAL)
A1CR1, A1CR2 A1CR3 SHORTED OR OPEN
EXTERNAL SYNC. TERMINALS SHORTED
A1C1, A1C2 OPEN OR SHORTED
A1CR8, A1CR9 OPEN OR SHORTED
A1R10 MISADJUSTED
A1R9 MISADJUSTED
A1R10 OPEN
R1a OR R1b OPEN
A1R3 OPEN
REMOTE FREQUENCY PROGRAMMING CIRCUIT OPEN
M2 DEFECTIVE
A1F1 FUSE BLOWN
A1C3, A1C4 OPEN OR SHORTED
A1R16 MISADJUSTED
A1T2 SHORTED OR OPEN
A1C6 OPEN OR SHORTED
A1CR1, A1CR2, A1CR3, A1CR4 OPEN OR SHORTED
REMOTE VOLTAGE PROGRAMMING CIRCUIT OPEN
T1 PRIMARY IMPROPERLY CONNECTED
F2 BLOWN
OUTPUT SHORTED AT TB1
R1 OPEN
NO OUTPUT VOLTAGE BUT FAN RUNS & PILOT LAMP IS LIGHTED (5 VAC INPUT ONLY)
F1 BLOWS WITHIN 1 SECOND AFTER UNIT IS TURNED ON
OUTPUT VOLTAGE 150 VAC OR MORE WITH NO LOAD ON OUTPUT
OUTPUT VOLTAGE TO LOW OR NEAR ZERO WITH NO LOAD OUTPUT
OUTPUT FREQUENCY TOO HIGH (350 CPS OR HIGHER)
OUTPUT FREQUENCY TOO LOW (350 CPS OR LOWER)
A1F1 REPEATEDLY BLOWS
PANEL LIGHT OUT BUT FAN RUNS (115 VAC INPUT ONLY)
S1 REPEATEDLY OPENS
NO OUTPUT VOLTAGE FAN DOES NOT RUN (230 VAC INPUT ONLY)
Q1, Q2, Q3 OR Q4 REPEATEDLY BLOWS
POOR FREQUENCY REGULATION
POOR VOLTAGE REGULATION

8000311

* THERE ARE 8 TRANSISTORS TO CHECK IN THE SWITCHING AMPLIFIER ON TFC-115-200 AND TFC-25-200.

FIG. 4-3

10-15-62


REMOTE
VOLTAGE
PROGRAM
GRN
YEL
NOTES:

NJE CORP KENILWORTH, N J
Replaceable Parts List.

Model TFC-26-200
TFC-115-200

Ref. Des.	Description & Size	NJE Part No. Main Assembly	Qty	Rec Spare	Rec. Vendor
A1	Circuit Card Subassy 83 PC-2	402545	1	1	23
A2	Heat Sink Subassy	102218	1	1	23
A3	Heat Sink Subassy	102217	2	1	23
A4	Same As A3				
A5	Tuning Fork 94PC	Consult		For Model suffix TF .005	
A5	Tuning Fork 94PC	Factory		For Model suffix TF. 05	
A5	Tuning Fork 94PC	For		For Model suffix TF. 01	
A5	Tuning Fork 94PC	Details		For Model suffix TF. 5	
B1	Blower	3B	1	1	28
C1	Capacitor 10 000 UF 50V	101520	2	1	23
C2	Capacitor 4UF 600V	1CO-600-4	2	1	27
CR1	Semi-Conductor Device	AG1012	4	2	17
CR2	Same As CR1				
CR3	Same As CR1				
CR4	Same As CR1				
DS1	Lamp, Cartridge	1DS-115-MB-N	1	1	13
F1	Fuse, Cartridge	1FFE-250-8	1	5	6
F2	Fuse, Cartridege	See Note 1	1	5	6
J1	Binding Post	1J-R	2		32
J2	Same As J1				
M1	Ammeter	See Note 2	1	1	16
M2	Voltmeter	See Note 3	1	1	16

NJE CORP KENILWORTH, N J
Replaceable Parts List

Model TFC 26-200
TFC 115-200

Ref Des	Description & Size	NJE Part No.	Qty	Rec Spare	Rec Vendor
Q1	Transistor	101892	1	1	23
R1	Res. Var WW Dual 100 Ω 2 W, WW Each Section	206566	1	1	23
R2	Res. Fixed WW 0 1, 50W	1RFW-50-0.1	1	1	33
S1	Switch, Toggle	1SW-SPST	1		19
T1	Transformer	204826			
T2	Transformer	204825			
TB1	Terminal Board	1TB12-12	1		8
XDS1	Lamp, Holder	1XDS-R	1		13
XF1	Fuse Holder	1XF	2		6
XF2	Same As XF1				

NJE CORP+KENILWORTH, N. J
Replaceable Parts List

Model TFC 26-200
TFC 115-200

Ref. Des	Description & Size	NJE Part No.	Qty	Rec Spare	Rec. Vendor
		Circuit Card Subassy 83PC-2 (A1)			
C1	Capacitor, Elect 25UF, 50V	1CT-50-25	3	1	27
C2	Same As C1				
C3	Capacitor, Elect 1000UF 50V	5CE-50-1000	1	1	27
C4	Capacitor Elect 200UF, 250V ATM-250-200		1	1	27
C5	Cap Metal, Paper 1UF, 200V	2CP-200-1.0	1	1	27
C6	Same As C1				
C7	Cap Metal, Paper .25UF 200V MPT1K2-P25		1	1	27
CR1	Diode Rect.	CER 530	16	6	29
CR2	Same As CR1				
CR3	Same As CR1				
CR4	Same As CR1				
CR5	Diode Rect 6V, ±5%	1N1983A	2	1	24
CR6	Same As CR1				
CR7	Same As CR1				
CR8	Same As CR1				
CR9	Same As CR1				
CR10	Same As CR5				
CR11	Same As CR1				
CR12	Same As CR1				

NJE CORP KENILWORTH, N.J
Replaceable Parts List

Model TFC.26-200
TFC 115-200

Ref. Des	Description & Size	NJE Part No.	Qty	Rec Spare	Rec Vendor
CR13	Same As CR1				
CR14	Same As CR1				
CR15	Same As CR1				
CR16	Same As CR1				
CR17	Same As CR1				
CR18	Same As CR1				
F1	Fuse, Cartridge 0 5A, 250V	1FFB-250-.5	1	5	6
Q1	Transistor Power	2N1760	3	1	10
Q2	Same As Q1				
Q3	Transistor Signal	2N1415	5	1	16
Q4	Same As Q3				
Q5	Same As Q3				
Q6	Not Used				
Q7	Same As Q1				
Q8	Same As Q3				
Q9	Same As Q3				
R1	Res Fixed, Comp. 4 7K, 1W	1RFC-1-4700	2	1	1
R2	Res. Fixed, Comp 10K, 1/2W	1RFC-1/2-10K	1	1	1
R3	Same As R1				
R4	Res Fixed Comp 47 1/2W ±	1RFC-1/2-47	2	1	1

NJE CORP KENILWORTH, N J
R placeable Parts List

Model TFC 26-200
TFC 115-200

Ref. Des	Description & Size	NJE Part No.	Qty	R c Spare	Re c Vendor
R5	Res. Fixed Comp 330, 1W, ±5%	2RFC-1-330	1	1	1
R6	Res. Fixed Comp. 2 2K 1/2W	1RFC-1/2-2200	2	1	1
R7	Res. Fixed, Comp. 820, 1/2W ±5%	2RFC-1/2-820	1	1	1
R8	Res Fixed Comp 470, 1/2W, ±5%	2RFC-1/2-470	1	1	1
R9	Rheostat WW 1000, 1. 5W Type 39x 1000 Ω ±20% Linear Printed CKT		2	1	9
R10	Same As R9				
R11	Same As R4				
R12	Rheostat WW 5 1. 5W Type 39x 5 Ω ±20% Linear Printed CKT		1	1	9
R13	Res. Fixed, WW 1. 5 3W 5%	2RFW-3-1 5	2	1	33
R14	Res. Fixed Comp. 1K 1/2W ±5%	2RFC-1/2-1K	1	1	1
R15	Res. Fixed WW 0 4 5W ±10%	2RFW-5-0. 4	1	1	33
R16	Rheostat WW 250 Ω, 1. 5W Type 39x 250 Ω ±20% Linear, Printed CKT		1	1	9
R17	Res. Fixed WW 82. 3W. ±5%	2RFW-3-82	1	1	33
R18	Res. Fixed Comp 1 8K 1/2W	1RFC-1/2-1. 8K	2	1	1

NJE CORP KENILWORTH, N J
Replaceable Parts List

Model TFC 26-200
TFC 115-200

Ref Des	Description & Size	NJE Part N	Qty	Rec Spare	Rec. Vendor
R19	Same As R18				
R20	Same As R6				
R21	Res. Fixed Comp 560, 1/2W	1RFC-1/2-560	1	1	1
R22	Res. Fixed. Comp. 15 1/2W±10%	1RFC-1/2-15	1	1	1
R27	Same As R2				
R28	Same As R13				
R29	Res. Fixed. Comp 22K 2W	1RFC-2-22K	1	1	1
T1	Transformer 400 cps Master	204686	1	1	23
T2	Transformer 115V/18V Isolation	101803	1	1	23
XQ1	Socket CJ54T2426		3		8
XQ2	Same As XQ1				
XQ3	Socket, Small Signal 3305		5		14
XQ4	Same As XQ3				
XQ5	Same As XQ3				
XQ6	Not Used				
XQ7	Same As XQ1				
XQ8	Same As XQ3				
XQ9	Same As XQ3				

NJE CORP. KENILWORTH N. J.
Replaceable Parts List

Model TFC 26-200
TFC 115-200

Ref. Des	Description & Size	NJE Part No	Qty	Rec Spare	Rec. Vendor
		Heat Sink Subassy (A2)			
Q1	Transistor	101892	3	1	23
Q2	Same As Q1	DELCO-728056, " 2N174			
Q3	Same As Q1				
R1	Res Fixed WW 0 1 5W	2RFW-5-0.1	2	1	33
R2	Same As R1				
S1	Switch Thermal Type S opens on Rise on High at 175° F	10SW-SPST	1		58
TB1	Terminal Board	2TB14-6	1		8
TB2	Terminal Board	2TB14-5	1		8
		Heat Sink Subassy (A3)			
CR1 & 2	Semi-Cond, Device	CER530	2	1	29
Q1	Transistor	101892	2	1	23
Q2	Same As Q1	DELCO-728056 / " — 2N174			
Q3	Transistor	2N1760	1	1	10
R1	Res. Fixed WW 0 1 5W	2RFW-5-0.1	2	1	33
R2	Same As R1				
TB1	Terminal Board	2TB14-5	2		8
TB2	Same As TB1				

NJE CORP. KENILWORTH, N J
Replaceable Parts List

Model TFC 26-200
TFC 115-200

Ref. Des.	Description & Size	NJE Part No.	Qty	Rec Spare	Rec Vendor
		Heat Sink Subassy (A4)			
CR1 & 2	Semi-Cond. Device	CER530	2	1	29
Q1	Transistor	101892	2	1	23
Q2	Same As Q1				
Q3	Transistor	2N1760	1	1	10
R1	Res. Fixed WW	2RFW-5-0.1	2	1	33
R2	Same As R1				
TB1	Terminal Board	2TB14-5	2		8
TB2	Same As TB1				
		MISCELLANEOUS			
	Handle 4 9/16 M.C BA-4		2		59
	Bracket, Cap CP07SA-4		4		27
	Bracket, Cap 13591		2		43
	Spacer 2126		2		43
	Thru-BOLT Ass'y Bolt No. 10x3/4 7PA50		1		25

NJE CORP. KENILWORTH, N. J.
Replaceable Parts List

Model TFC 26-200
TFC 115-200

Ref. Des.	Description & Size	NJE Part No.	Qty	Rec. Spare	Rec. Vendor

Parts List Notes

1. Fuse (F2) for the ETFC/TFC 115-200 unit is NJE part No. 1FFB-250-2 and for ETFC/TFC-26-200 the fuse is same as fuse (F1).

2. Ammeter (M1) for the TFC 115-200 unit is a 0 to 3 amps 400cps meter with NJE part No. 1M-2-3AAC and for TFC 26-200 unit a 0 to 10 amp 400 cps with NJE part No. 1M 2-10AAC. None are provided for ETFC line.

3. Voltmeter (M2) for the TFC 26-200 unit is a 0 to 50 V 400 cps meter with NJE part No. 1M 2-50V AC and for TFC 115-200 unit a 0 to 150V 400 cps with NJE part No. 1M 2-150 V AC. None are provided for ETFC line.

List of Code Numbers used in

Replaceable Parts List

To Indicate Manufacturer

Code Number	Manufacturer	Location
1	Allen-Bradley Co.	Milwaukee, Wisconsin
2	Astron	East Newark, N. J.
3	Barber Colman Co.	Rockford, Illinois
4	Helipot (Div of Beckman Inst)	Fullerton, Calif.
5	Bourns, Inc.	Riverside, California
6	Bussmann (Div of Mc-Graw Edison)	St. Louis. Mo.
7	Centralab Elect (Div of Globe Union)	Milwaukee, Wisconsin
8	Cinch Mfg Co. (H. B. Jones Div)	Chicago, Ill
9	Clarostat Mfg Co.	Dover, New Hampshire
10	Clevite Transistor	Waltham, Mass.
11	Columbus Electronics	Yonkers, N. Y.
12	Dale Elect (Sub of Hathaway Ins Inc).	Columbus, Nebraska
13	Dialight Corp.	Brooklyn, N. Y.
14	Elco Manufacturing	Philadelphia, Pa.
15	Fansteel	No. Chicago, Ill.
16	General Electric	Syracuse, N. Y.
17	General Instrument	Newark, N. J.
18	General Transistor	Los Angeles, Calif.
19	Herman H. Smith	Brooklyn, N. Y.
20	Hoffman	El Monte, Calif.
21	Little Fuse	Des Plaines, Ill.
22	Motorola	Phoenix, Ariz.
23	NJE Corporation	20 Boright Ave. Kenilworth, N. J.

Code Number	Manufacturer	Location
24	North Amer Elect (Affiliate of I. R. C.)	West Lynn, Mass.
25	Ohmite	Skokie, Ill.
26	Philco	Lansdale, Pa.
27	Pyramid Elec Co. (Div of Gen Inst)	Darlington, S. C.
28	Rotron	Woodstock, N. Y.
29	Solitron	Norwood, N. J.
30	Spectrol	San Gabriel, Calif.
31	Sprague	North Adams, Mass.
32	Superior Electric Co.	Bristol, Conn.
33	Tru-Ohm (Model Eng)	Chicago, Ill.
34	U.S. Semcor	Phoenix, Arizonia
35	Westinghouse	Youngwood, Pa.
36	Standard Electric Co.	Dayton, Ohio
37	Stancor Electronics, Inc.	Chicago, Ill.
38	Jettron Products	Hanover, N. J.
39	Dickson Electronics Corp.	Scottsdale, Ariz
40	Aerovox Corp.	New Bedford, Mass.
41	Radio Switch (formerly Communication Prod Corp)	Marlboro, N. J.
42	Radio Corp of Amer (Elect Tube Div)	Harrison, N. J.
43	Cornell Dublier (Div of Fed Pacific Elect)	Newark, N. J.
44	Chicago Cond Corp.	Chicago, Ill.
45	Arco Electronics	Great Neck, N. Y.
46	International Resistance Co.	Philadelphia, Pa.
47	Amperex Electronics Corp.	Hicksville, N. Y.

Code Number	Manufacturer	Location
48	Resistor Prod Co.	Harrisburg, Pa.
49	Syntron Co.	Homer City, Pa.
50	Amphenol Connector (div of Amphenol-Borg)	Chicago, Ill
51	Continental-Wirt	Philadelphia, Pa.
52	Royal Electric Corp.	Pawtucket, R. I.
53	National Resistance Co.	Pearl River, N. J.
54	Radio Switch Corp. (formerly Communication Prods Co Inc.)	Marlboro, N. J.
55	G. V. Control Inc.	Livingston, N. J.
56	Harvey Hubbell Inc.	Bridgeport, Conn.
57	Howard Industries	Festos, Mo.
58	Stevens Mfg.	Mansfield, Ohio
59	Vemaline Prod Co.	Franklin Lakes, N. J.
60	Delco Radio (div of General Motors Corp)	Kokomo, Ind.
61	Rogan Brothers, Inc.	Skokie, Ill.
62	Milton Ross Metals Co.	Hatboro, Pa.
63	Birtcher Corp.	Moniterey Park Col.
64	Cambridge Thermionics Corp.	Cambridge, Mass.
65	U.S. Eng Co (div of Litton Ind)	Mount Vernon, N. Y.
66	Augut Bros Inc.	Atteboro, Mass.
67	Bourns Inc.	Riverside, Calif.
68	Chicago Standard Trans Co.	Chicago, Ill.
69	Cutler-Hammer Inc.	Milwaukee, Wisc.
70	Allied Control Co. Inc.	New York, N. Y.
71	The Rowan Controller Co.	Baltimore, Md.
72	Kurman Electric Co. (Sub of Crescent Petroleum Corp)	Brooklyn, N. Y.
73	Arco Electronics Inc. Elemenoo	New York, N. Y.

Code Number	Manufacturer	Location
74	Texas Instrument Inc.	Dallas, Texas
75	P.R. Mallory & Co. Inc.	Indianapolis, Ind.
76	Kurz-Kasch Inc.	Dayton, Ohio
77	Transitron Elec Corp.	Wakefield, Mass.
78	Amperite Inc.	New York, N. Y.
79	Eitel-McCullough, Inc (EIMAC)	San Carlos, Calif.
80	E.F. Johnson Co.	Waseca, Minn.
81	Harry Davies Molding Co.	Chicago, Ill.
82	Potter-Brumfield (div of Amer Machine Foundry Co.)	Princeton, Ind.
83	Furnas Electric Co.	Batavia, Ill.
84	James Millen Mfg. Co.	Malden, Mass.
85	Burndy Corp.	Norwalk, Conn.
86	Heyman Mfg Co.	Kenilworth, N. J.
87	Tinnerman Prod Inc.	Cleveland, Ohio
88	National Radio Co. Inc.	Melrose Mass.
89	Raytheon Co.	Newton, Mass.
90	Military Specifications	No Location
91	Electronic Ind Assoc (EIA)	No Location
92	E. W. Corp.	Hillside, N. J.
93	Accutronics Inc. (Sylverster Assoc)	Springfield, N. J.
94	J. W. Miller Co.	Los Angeles, Calif.
95	Industrial Timer Corp.	Newark, N. J.

MANUFACTURERS REPRESENTATIVES

Albuquerque, New Mex.

Barnhill Associates
319A Wyoming N.E., Albuquerque, New Mex.
265-7766

Boston, Mass.

Burlingame Associates, Ltd.
7 Wellington Street, Waltham, Mass.
TWinbrook 4-1955

Chicago, Ill.

Ridgway Associates
6100 W. North Ave., Chicago 39, Ill.
TUxedo 9-5715

Cleveland, Ohio

Ridgway Associates
5915 Schaaf Rd., Cleveland 31, Ohio
LAfayette 4-1421

Dallas, Texas

Carey-Wolf Co.
P.O. Box 12425, Ft. Worth, Tex.
TA 3-5383

Dayton, Ohio

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3898 Linden Ave., Dayton 29, Ohio
CLearwater 2-5604

Denver, Colo.

Barnhill Associates
1170 South Sheridan Blvd., Denver, Colorado
WEst 5-4645

Detroit, Mich.

Ridgway Associates
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LIncoln 6-3312

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PE 8-1702

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Ridgway Associates
1224 N. Capitol Ave., Indianapolis 2, Indiana
MElrose 5-2401

Kansas City, Mo.

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NIagara 2-3313

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MUrray 1-3292

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REgent 9-5517

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MOunt Vernon 4-7530

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222-3261

Philadelphia, Pa.

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JAckson 8-6080

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WHitney 6-5521

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MIssion 7-1470

Salt Lake City, Utah

Barnhill Associates
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AXtel 5-6521

San Diego, Calif.

G. S. Marshall Company
4410 Kearny Mesa Rd., San Diego, Calif.
BR 8-6350

San Francisco, Calif.

G. S. Marshall Company
801 Woodside Rd., Redwood City, Calif.
EMerson 6-8214

Seattle, Washington

Burt C. Porter Company
1209 Poplar Place, Seattle 44, Washington
EAst 3-8330

Syracuse, N. Y.

Burlingame Associates, Ltd.
514 University Bldg., Syracuse, N. Y.
GRanite 4-7409

Washington, D.C.

Burlingame Associates, Ltd.
8218 Wisconsin Ave., N.W., Washington 14, D.C.
OLiver 4-6400

Winston-Salem, N.C.

M. J. McDonald Co.
Whippoorwill Drive, Rt. 1, Pfafftown, N. C.
WAbash 4-2182

OUR WARRANTY: N J E Corp. warrants each power supply manufactured by them to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose and to replacing any defective parts thereof, except tubes, semi-conductors and fuses. This warranty is effective for one year after delivery to the original purchaser when the instrument is returned, transportation charges prepaid by the original purchaser, and which upon our examination is disclosed to our satisfaction to be defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started. Written permission must be obtained from the factory, before a supply may be returned for examination.

NJE CORPORATION
Electronic Development & Manufacturing
Kenilworth, New Jersey • BRidge 2-6000
TELEFAX: FFP • TWX: URANFORD 51